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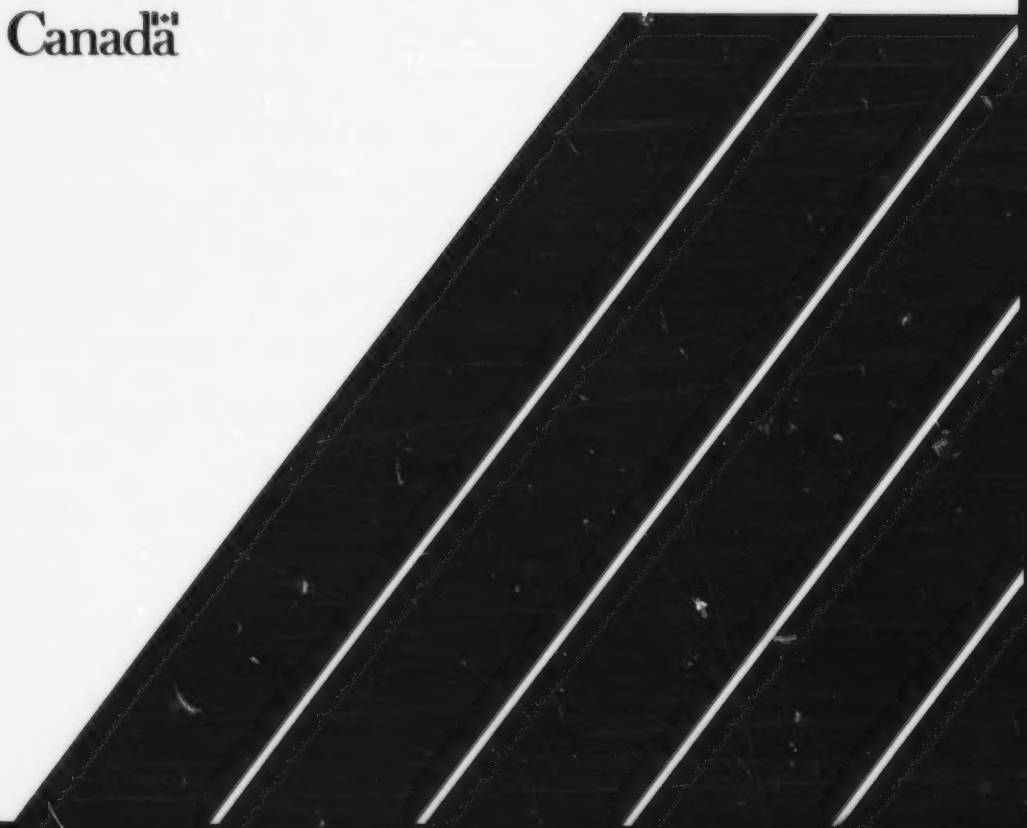
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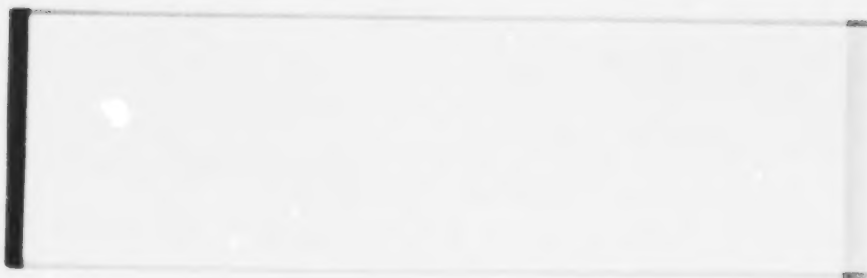
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MINE ROADWAY SURVEYS - RECOMMENDATIONS
FOR AN OPTIMUM SURVEY INTERVAL

T.R.C. Aston

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MICROMEDIA



MINE ROADWAY SURVEYS - RECOMMENDATIONS
FOR AN OPTIMUM SURVEY INTERVAL

by

T.R.C. Aston*

SUMMARY

In July 1987, a detailed height survey of 1300 arches was undertaken in the 9 East bottom level of the Lingan Mine, Sydney Coalfield, N.S. This report presents recommendations, based on the collected data, for the optimum arch interval which should be used for all future roadway monitoring surveys.

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RELEVÉS DE SURVEILLANCE DES VOIES MINIÈRES-
RECOMMANDATIONS POUR UN INTERVALLE OPTIMAL DE SURVEILLANCE

par

T.R.C. Aston

RÉSUMÉ

En juillet 1987, un relevé détaillé des hauteurs de 1300 arches a été réalisé dans la voie de base 9 East de la mine Lingan, dans le champ houiller de Sydney (N.-É.). Dans le présent rapport, des recommandations sont faites, à partir des données recueillies, sur l'intervalle optimal à utiliser dans l'avenir dans tous les relevés de surveillance des voies.



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INTRODUCTION

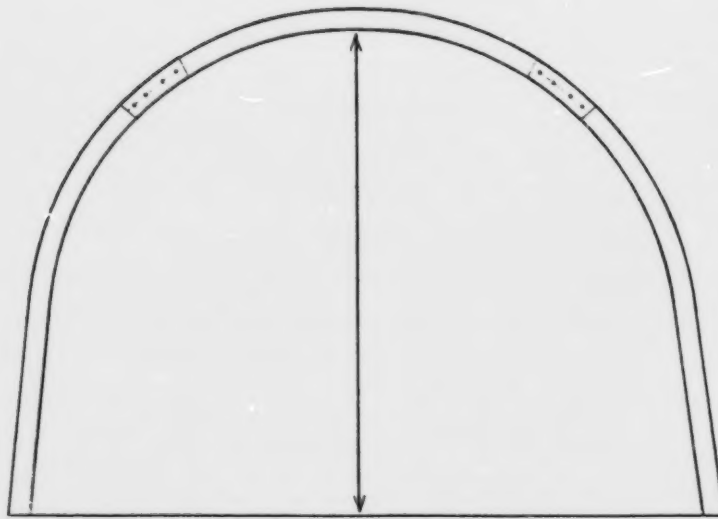
The rapid collection of field data is often essential for the understanding of gateroad/roadway deformation mechanisms (1). In 1983, an extensive roadway deformation survey program was undertaken by the Cape Breton Coal Research Laboratory (CBCRL), as part of an ongoing barrier pillar research program in the Sydney Coalfield (2). The survey resulted in the collection of some 35 km of roadway deformation data (roadway height, width and cross-sectional area) from the Lingan and No. 26 Mines. Vertical height data was collected every 10 arches (0.9 m spacings) from the faceline position to the original face startline location. The measurements were taken from the arch crown to the floor. Roadway width (1 m above the floor) and arch profile (photographic) data was also collected every 50 arches. This data was subsequently analysed at McGill University via an EMR-RAP agreement (3).

As a result of this work, questions arose concerning the optimum arch spacing interval for the collection of vertical roadway height data. In July 1987, CBCRL undertook a detailed height survey of 1300 arches (at 1 Arch intervals) along the 9 East bottom level at Lingan Mine. This report presents recommendations, based on the survey data, for the optimum arch spacing interval that should be adopted for future roadway monitoring programs.

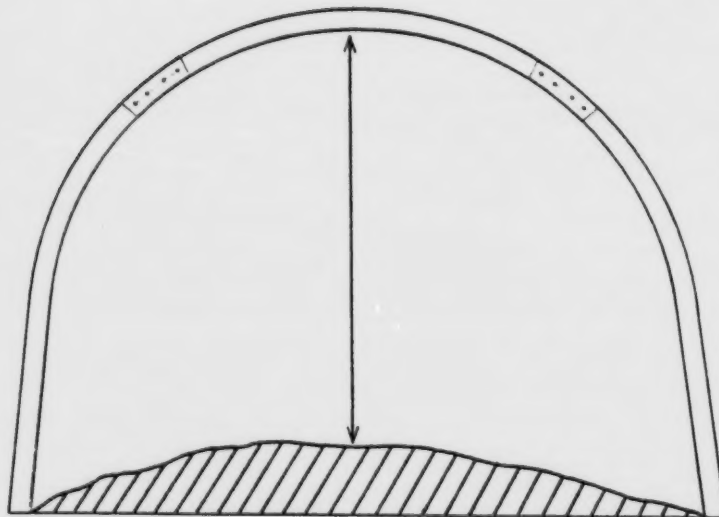
DATA COLLECTION AND PROCESSING

Vertical height measurements were taken at 1 Arch intervals along the Lingan Mine 9 East bottom level. Measurements were taken from the arch crown to the roadway floor, Figure 1. In each case, care was taken to ensure that the floor consisted of level, representative material which was not covered with obviously foreign material such as 'large' loose rocks, timbers, garbage, etc. An alternative technique which can also be used is to measure from the arch crown to the track sleepers or base of the rails. However, this method poses problems in the near face region where the track has not yet been laid.

2



a) Original arch height



b) Roadway working height

Figure 1 - Vertical height measurements
from arch crown to roadway floor

Once collected, the data was transferred to an IBM-AT/PC using spread-sheet software. A series of graphs were then plotted, showing height profiles along the roadway at 1,2,3,5 and 10 arch intervals, Figures 2 to 6.

Appendix A (Figures 2A - 6A) contains the same data at the same arch intervals, which has been processed using a 5-point rolling mean.

DISCUSSION

Roadway height measurements (vertical distance between the arch crown and floor/track) are often referred to as 'roadway deformation' measurements. This terminology is not correct, since true roadway deformation measurements would require height, width and/or arch profile/cross-sectional area measurements at each of the intervals monitored. The roadway height measurements collected during this type of survey represent the 'roadway working height'. Normally, roadway deformation is inferred to mean the reduction in roadway height/profile due to strata movement. However, the 'working height' measurements are actually influenced by four main factors:

- 1) Roof strata displacement
- 2) Floor heave
- 3) Arch leg penetration into the floor
- 4) Waste rock/material not removed
from the roadway floor

Experience indicates that the survey method, using experienced personnel, can give results with an accuracy of much better than ± 5 cm, which with a 12 ft (3.65 m) arch is better than $\pm 1\%$.

It is difficult to analyse the results presented in Figures 2 to 6. However, a subjective visual assessment indicates:

- 1) The 1 Arch interval (Figure 2) presents a very detailed roadway profile which allows every minor variation to be analysed. However, the survey is very time consuming in terms of both its manpower and data processing requirements.

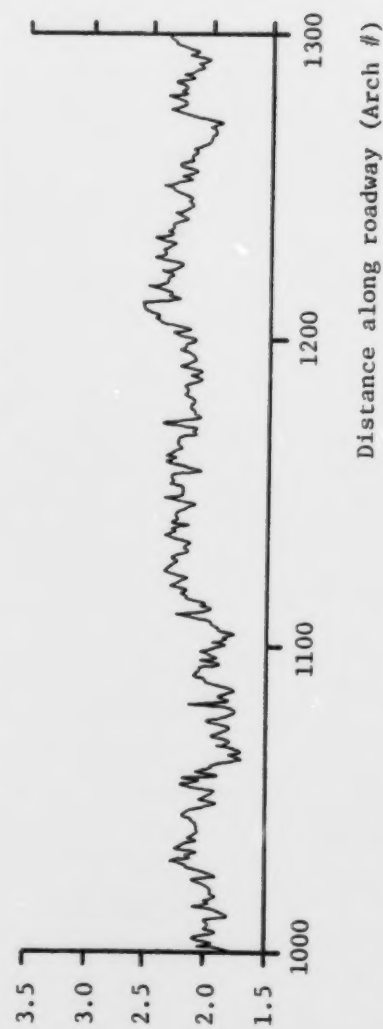
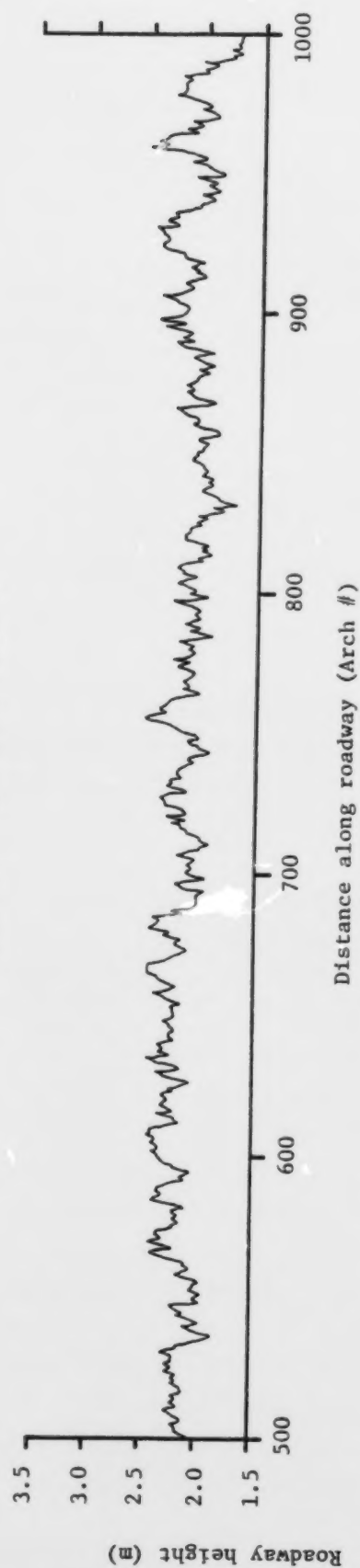
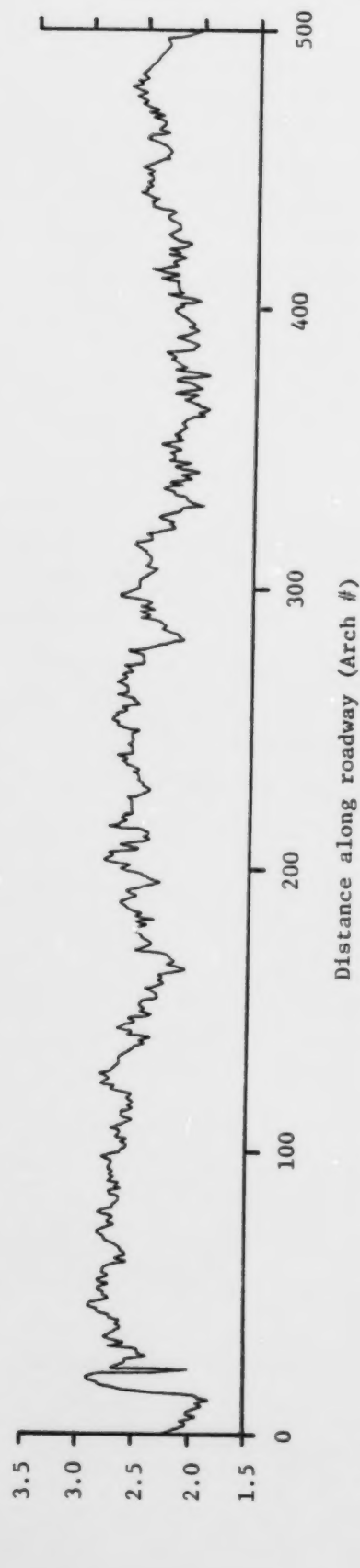


Figure 2 - Roadway height profile, 1 Arch interval, 9 East bottom level, Langan Mine

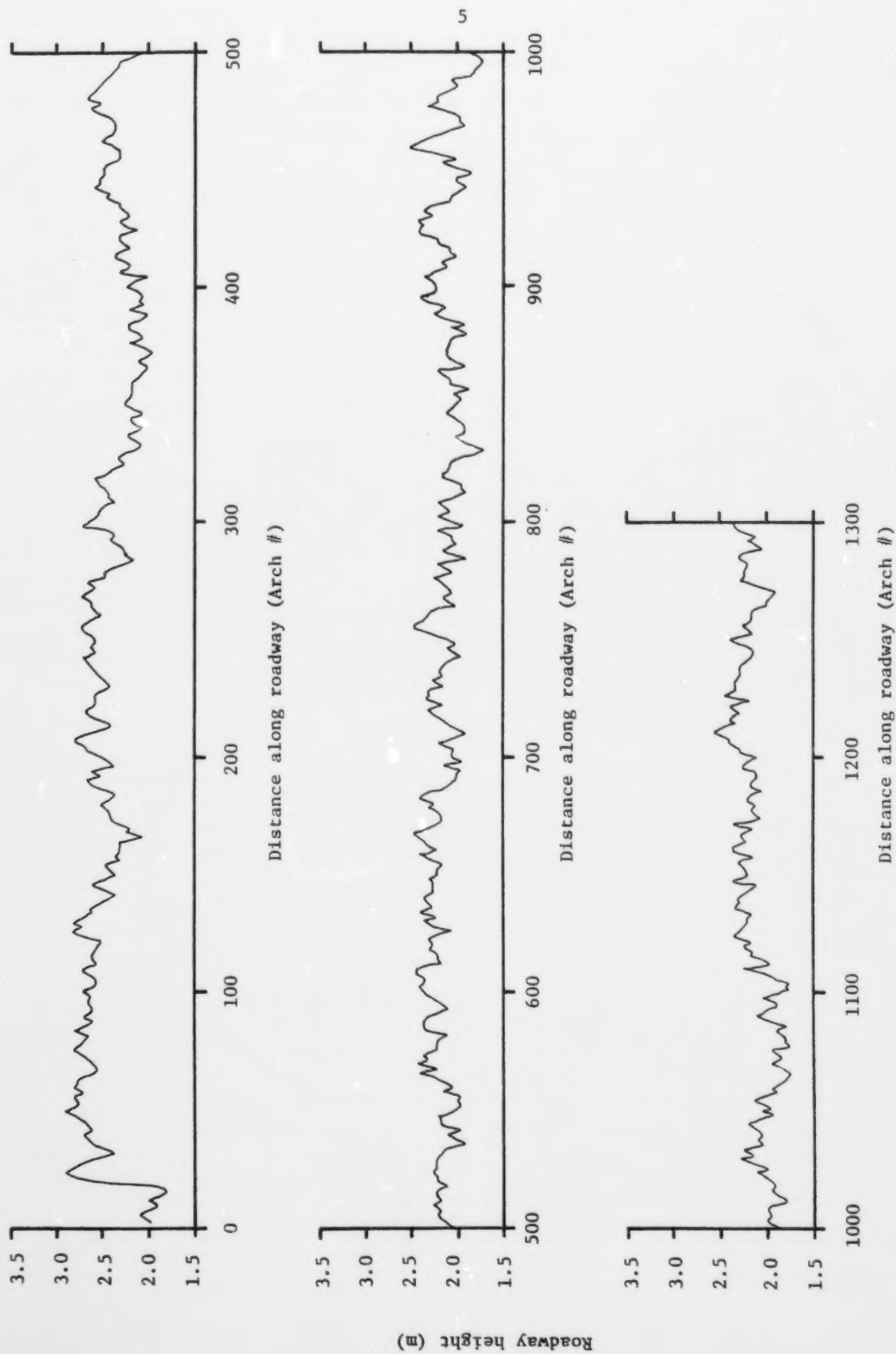
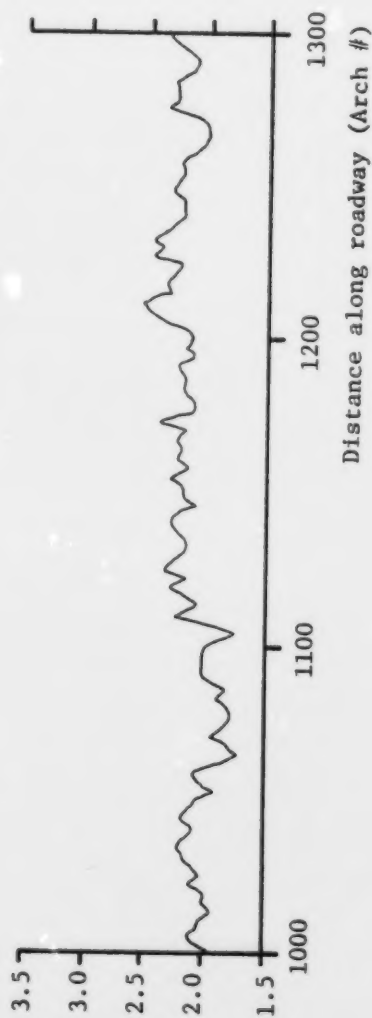
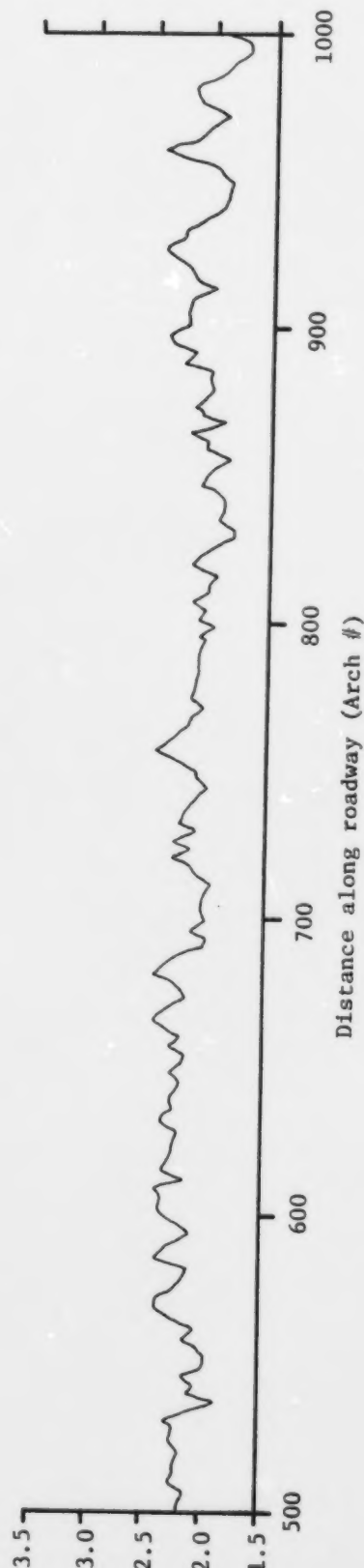
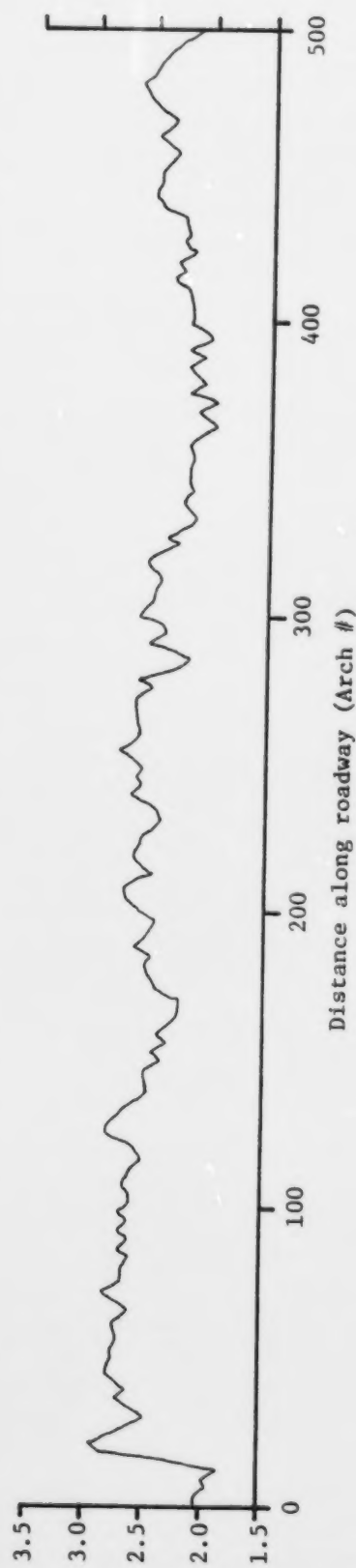


Figure 3 - Roadway height profile, 2 Arch interval, 9 East bottom level, Lingan Mine



Roadway height (m)

Figure 4 - Roadway height profile, 3 Arch interval, 9 East bottom level, Lingam Mine

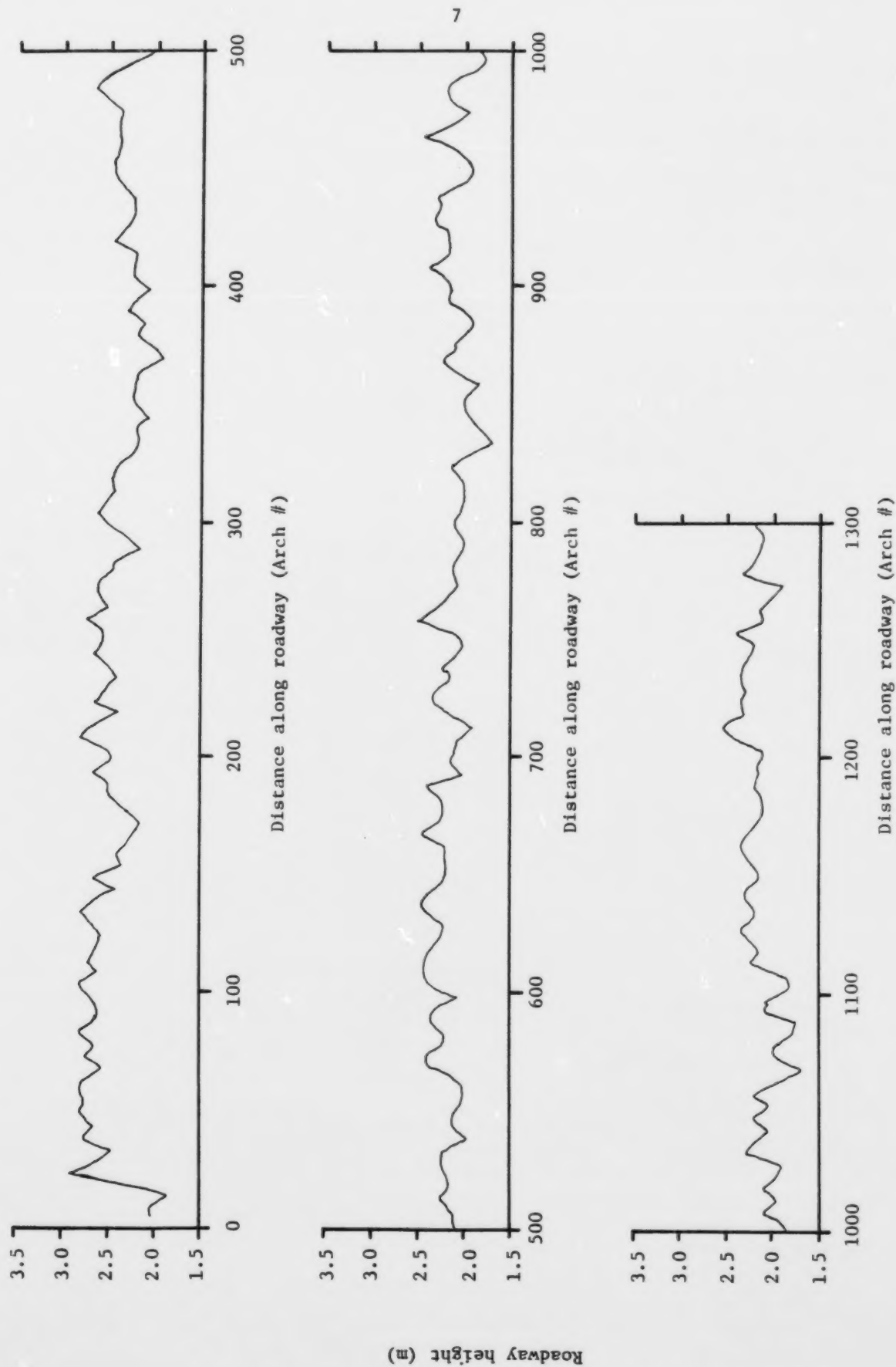


Figure 5 - Roadway height profile, 5 Arch Interval, 9 East bottom level, Langan Mine

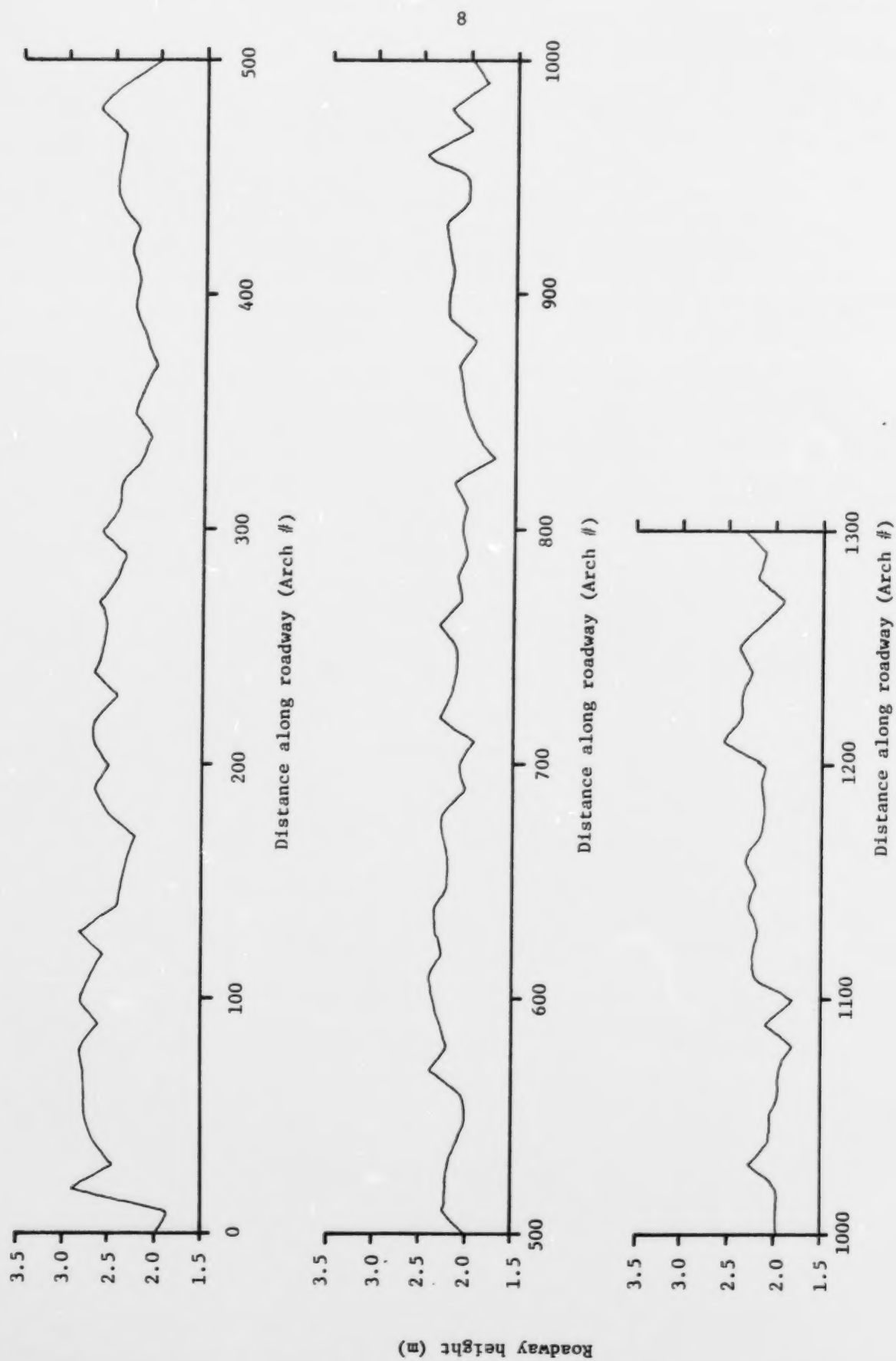


Figure 6 - Roadway height profile, 10 Arch interval, 9 East bottom level, Langan Mine

- 2) The 2 and 3 Arch intervals (Figures 3 and 4) smooth minor irregularities, but still provide sufficient detail to analyse local variations in the data set.
- 3) The 5 Arch interval (Figure 5) further smoothes local variations in the data set, but still maintains sufficient detail for a meaningful analysis.
- 4) The 10 Arch interval significantly smoothes local variations in the data and effectively presents only a broad indication of the deformation trends. The interval is considered too widely spaced to undertake a detailed analysis of the data.

When subjected to a 5-point rolling mean, the data becomes smoothed, with both minor and local variation rapidly disappearing. The 1 Arch rolling mean profile appears comparable to the 3 Arch interval profile. Similarly, the 2 Arch rolling mean profile appears comparable to the 10 Arch interval profile. The 3 and 5 Arch rolling mean profiles could be used for a broadly based analysis, but the 10 Arch rolling mean profile is considered unsuitable for any type of analytical treatment.

RECOMMENDATIONS

Based on the information presented in the discussion section, the following recommendations are made:

- 1) The 3 Arch interval should be adopted as the standard spacing for all roadway surveys, since it provides sufficient data to undertake a detailed analysis, while optimising manpower data collection and processing requirements.
- 2) The use of 'rolling means' as a smoothing process for the data is not recommended, since it significantly masks potentially significant minor and local variations which might occur in the roadway data set.

REFERENCES

1. Whittaker, B.N. "Recording, treatment and interpretation of roadway deformation surveys"; Min. Eng. (U.K.); July 1976; pp. 607-617.
2. Cain, P. and Aston, T.R.C. "Detailed back analysis of barrier pillar performance in the Sydney Coalfield"; Proc. ISRM Symp - Design and Performance of Underground Structures; September 3-6, 1984, Cambridge, U.K.; pp. 431-436.
3. Hassani, F.P. and Majdi, A. "A study of tunnel stability and barrier pillar design in mines of the Cape Breton coalfield"; EMR-RAP Project; Dept. Min. and Metall. Eng., McGill University, Montreal; August 1988.

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APPENDIX A

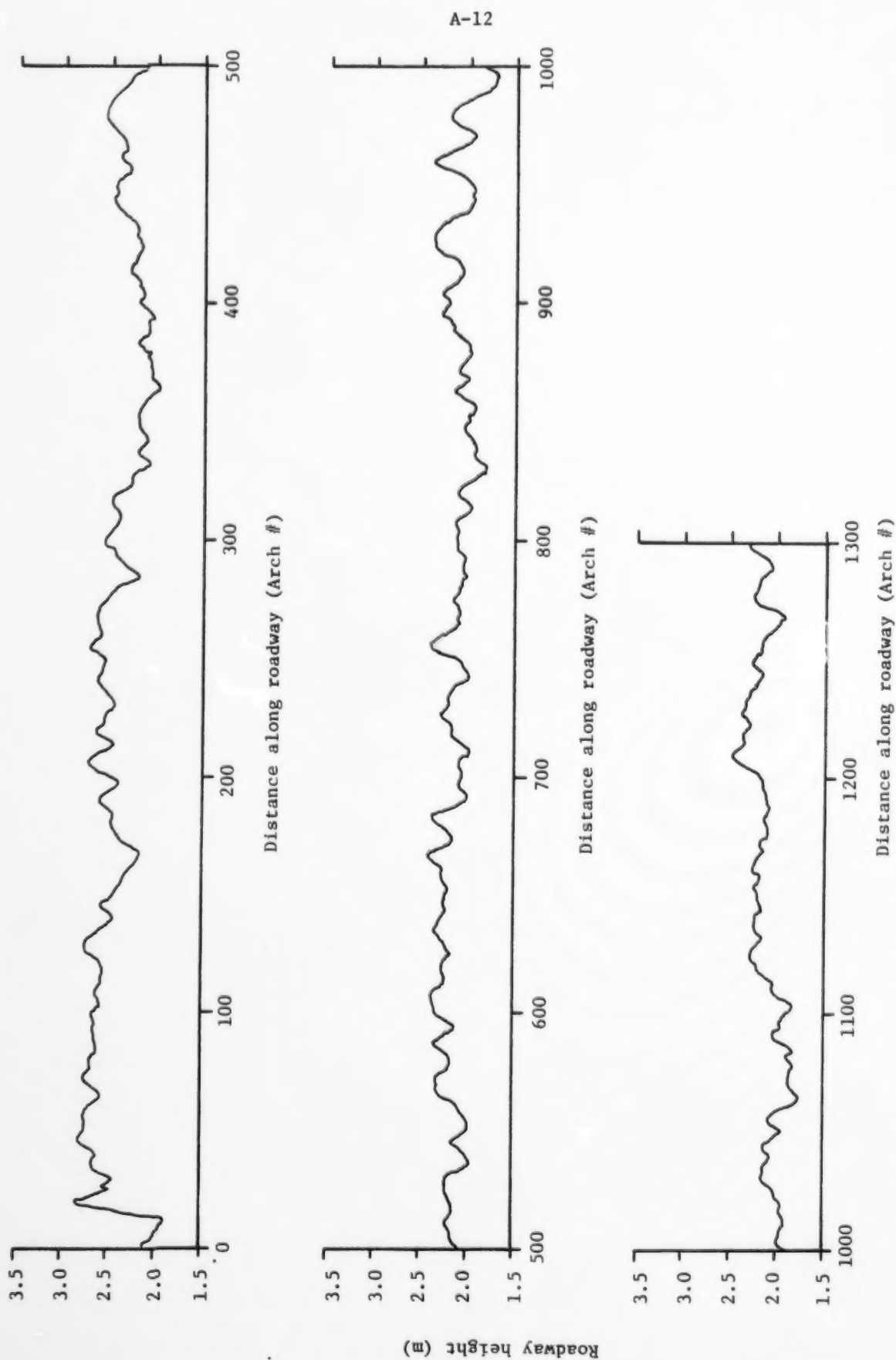


Figure 2A - Roadway height profile, 1 Arch interval, 5-point rolling mean, 9 East bottom level, Lingam Mine

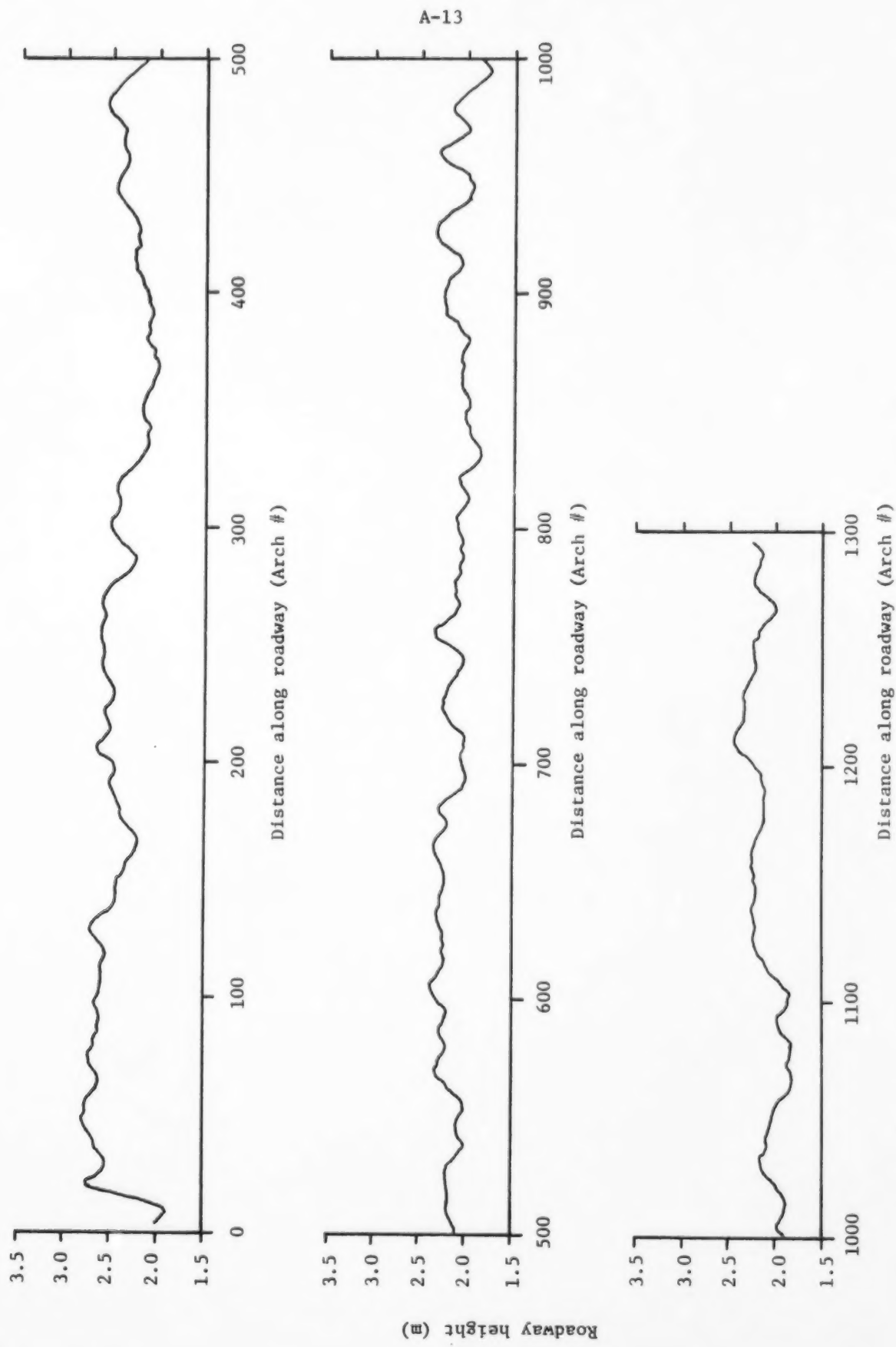


Figure 3A - Roadway height profile, 2 Arch interval, 5-point rolling mean, 9 East bottom level, Lingam Mine

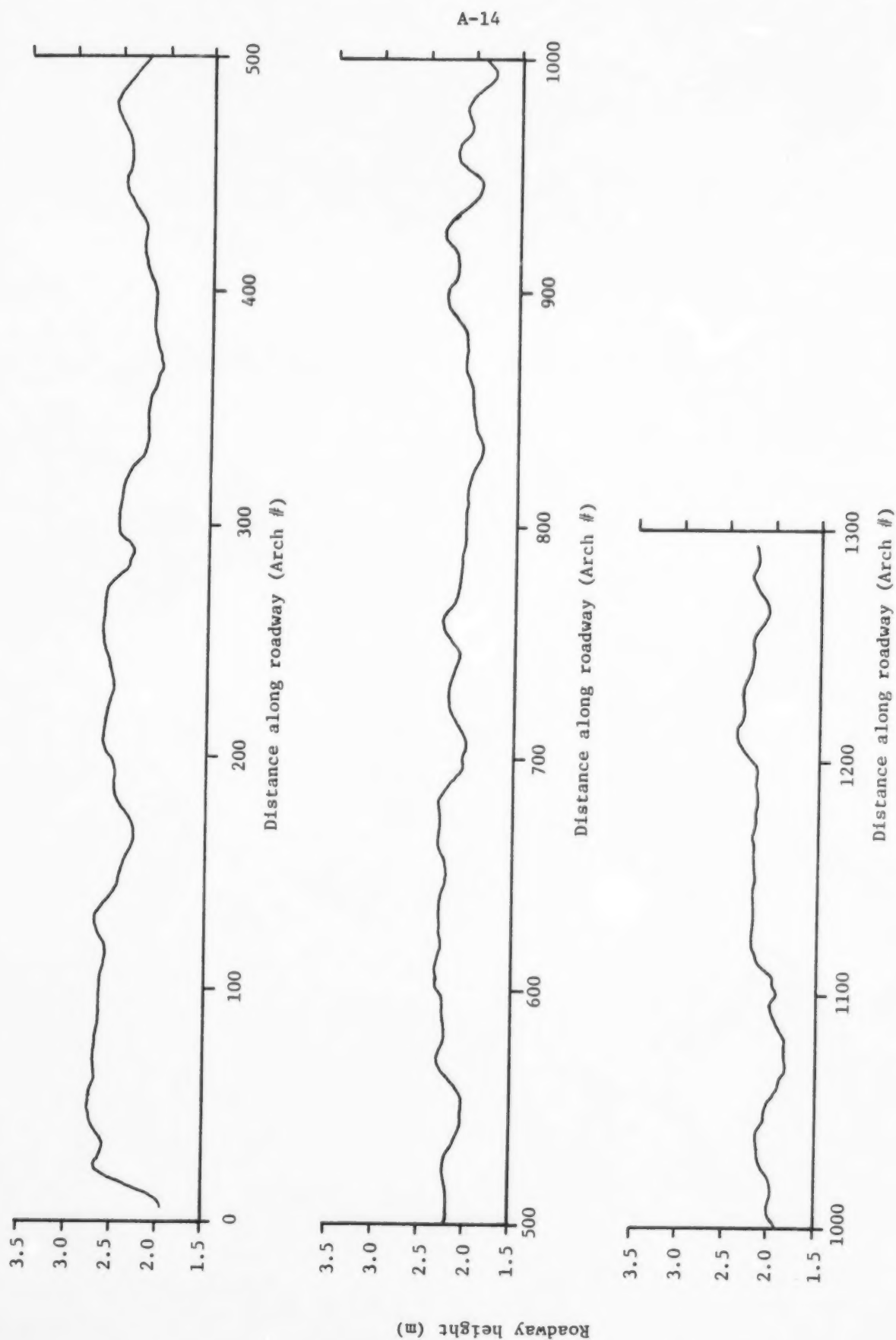


Figure 4A - Roadway height profile, 3 Arch interval, 5-point rolling mean, 9 East bottom level, Langan Mine

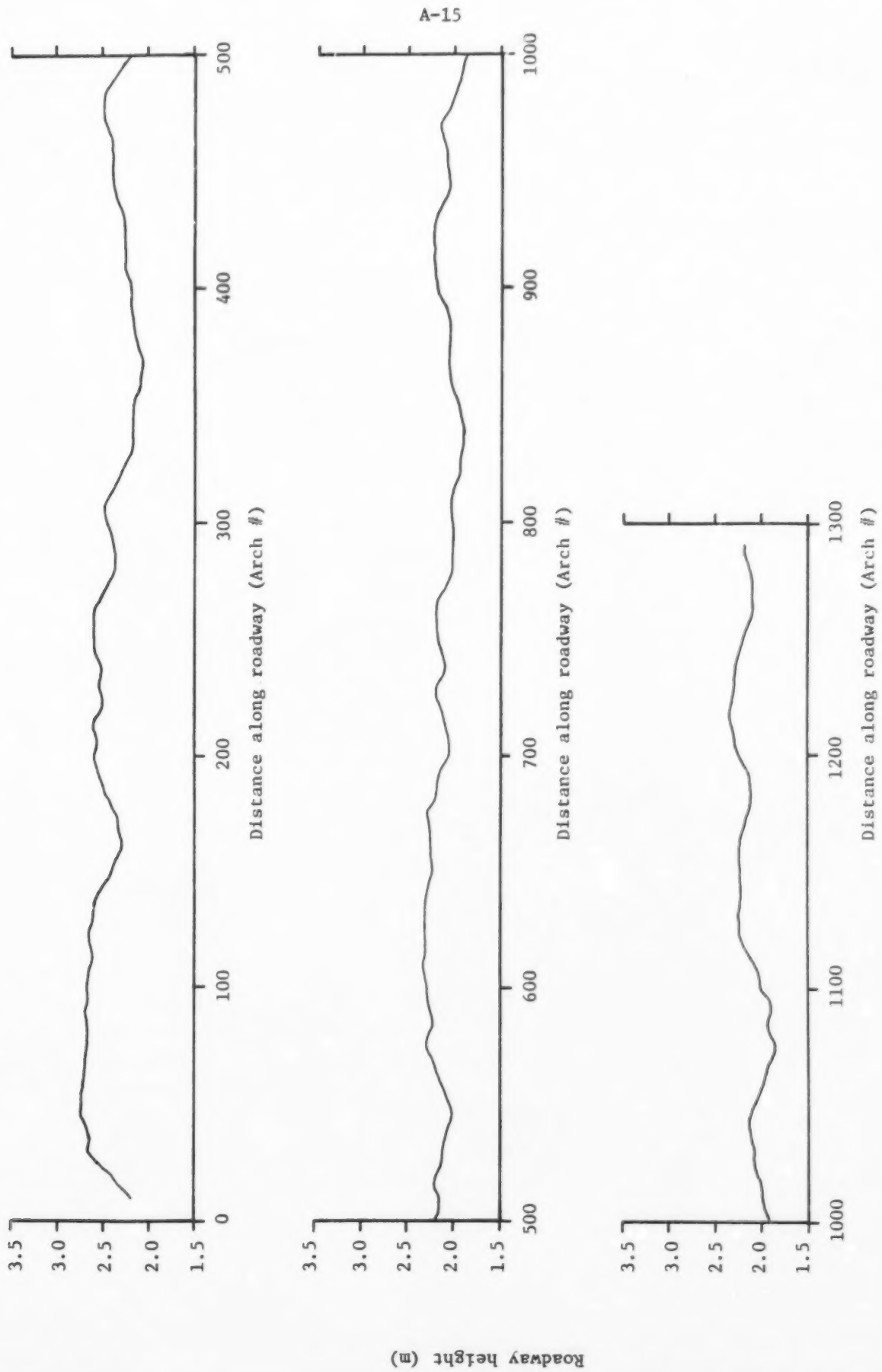


Figure 5A - Roadway height profile, 5 Arch interval, 5-point rolling mean, 9 East bottom level, Lingan Mine

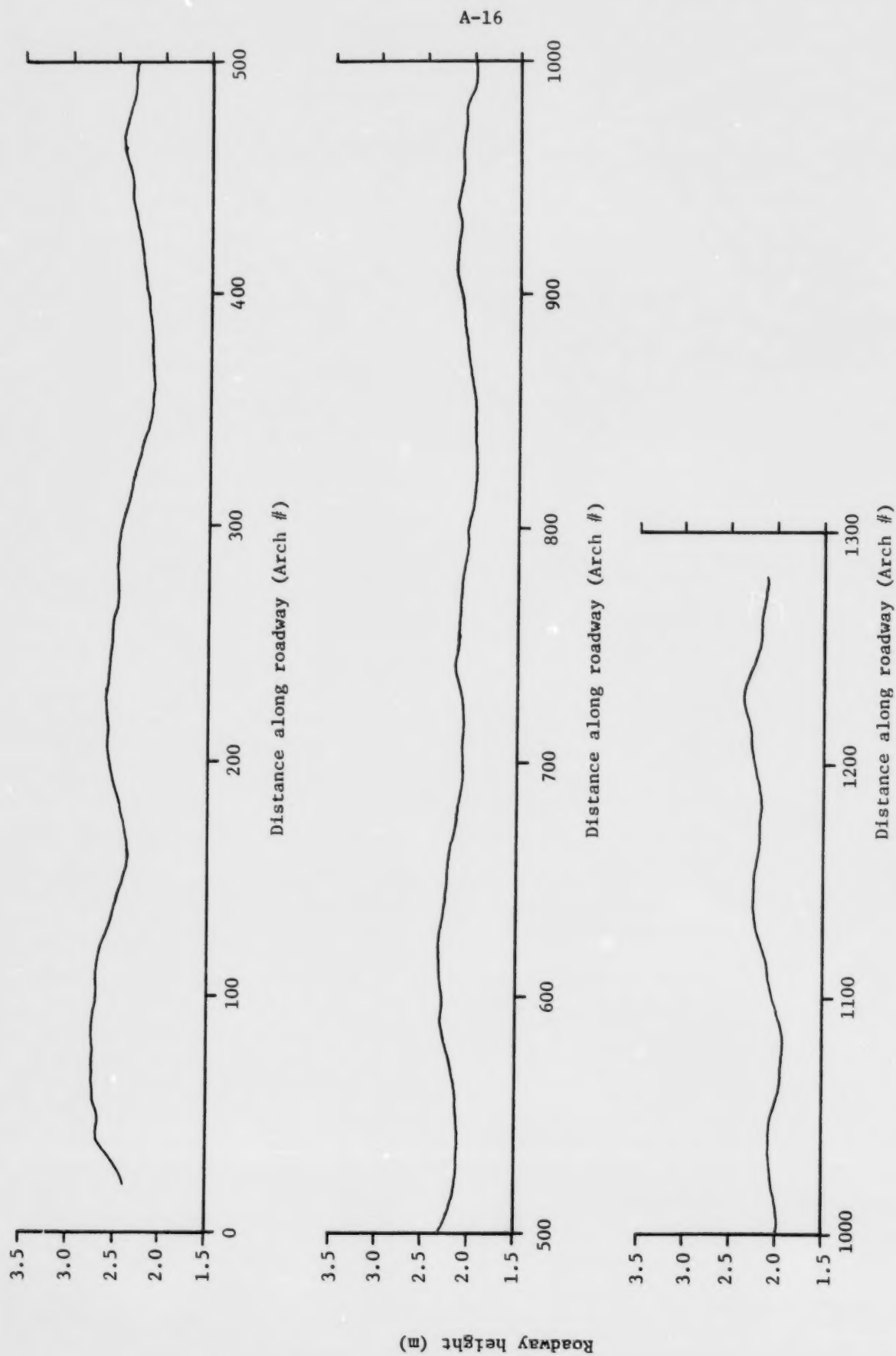


Figure 6A - Roadway height profile, 10 Arch interval, 5-point rolling mean, 9 East bottom level, Langan Mine